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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/848,725	05/04/2001	Chien-Jen Chen	ONETTA-67	8417

7590 05/30/2002

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EXAMINER	
SOMMER, ANDREW R	
ART UNIT	PAPER NUMBER
3663	

DATE MAILED: 05/30/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/848,725	CHEN ET AL.	
	Examiner	Art Unit	
	Andrew R Sommer	3663	

-- Th MAILING DATE of this communication app ars on the cover sh et with the correspond nc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 April 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,13,14 and 19-23* is/are rejected.

7)☒ Claim(s) *11,12 and 15-17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Drawings

The corrected or substitute drawings were received on 06 November 2001. These drawings are accepted.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 4, 6, 7, 9, 13, 18, 19, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacKichan ('404) (hereafter "MacKichan") in view of Grubb et al. ('922) (hereafter "Grubb")

Regarding claim 1, MacKichan teaches optical amplifier equipment that amplifies optical data signals in a fiber-optic communications link that has at least one span of transmission fiber for carrying the optical data signals, comprising: (1) a pump that produces pump light that creates gain for the optical data signals in the span of transmission fiber, Fig. 1, 13; (2) at least one optical monitor that measures backscattered pump light from the span of transmission fiber, Fig. 1, 15; (3) a control unit that uses the pump and the optical monitor to perform optical time domain reflectometry measurements on the transmission fiber. See *inter alia*, columns 3-6. MacKichan does not teach that the amplifier is a Raman amplifier, or that the pump is configured to produce Raman gain. Raman amplifiers using the optical transmission

fiber as a gain medium are well known in the art. Such amplifiers require the use of pumps configured to produce Raman gain. The Grubb reference discloses:

> *"The signal varying device can be embodied as a distributed device that employs a portion or all of an optical transmission fiber extending between two optical nodes, such as between an optical transmitter and an optical receiver. The signal varying device can also be embodied as a lumped or concentrated device that is placed in the optical transmission fiber at discrete locations between the optical nodes.*
>
> *The pump wavelengths are selected such that the combined Raman gain resulting from the pump energy supplied by each pump wavelength produces a desired signal variation profile in the signal wavelength range."* Grubb et al. ('922) at columns 3 and 4, lines 66-10.

Furthermore, the MacKichan reference teaches that the modifications to the typical controller in an amplifier are simple to implement so that the pumping source can be used to perform OTDR. See generally, column 7, lines 16-33. It would have been obvious to modify MacKichan to utilize the transmission fiber as a gain medium, and use a Raman pump rather than a pump for a rare-earth-doped fiber amplifier because the use of Raman amplifiers rather than EDFAs is a well known substitution, which can lead to increased amplification bandwidth, and is commonly implemented in the prior art.

Regarding claim 4, MacKichan teaches that a single pump wavelength is modulated to produce a series of pulses where the pulses are used to perform OTDR on the transmission system. MacKichan does not teach that a second pumping wavelength can be modulated to produce a change in the Raman gain. Such is taught in the prior art of Grubb. Grubb teaches that the Raman gain profile of the amplifier can be modified to any desired spectrum by adjusting the pumping intensities of the pump. See generally, the Abstract. It would have bene obvious to modify MacKichan to

include a second wavelength of pumping light that is modulated to produce changes in the Raman gain of the span because such a configuration is well known in the art and would lead to constant amplification power for the OTDR pulses.

Regarding claim 6, MacKichan teaches that the control unit is used to control the pump light for an erbium-doped fiber coil. See specifically, column 6.

Regarding claim 7, MacKichan teaches that an optical splitter is used to split-off the backwards scattered pump light from the optical data signals, the splitter is a wavelength selective splitter that works to separate the pump wavelength from the other wavelengths in the system. This is a WDM coupler. See generally, column 5.

Regarding claim 9, MacKichan teaches a WDM coupler, 21, that is coupled to the fiber that separates the backscattered pump light from the optical data signals being amplified on the span and directs the separated backscattered Raman pump light to the monitor, 15. MacKichan does not teach that there is a circulator for directing the pump light into the span of transmission fiber. Grubb teaches that the pump light is commonly introduced into the fiber span using an optical circulator. See column 12, beginning at line 15. See also the third full paragraph of column 7.

Regarding claim 13, MacKichan teaches that the pumping light is modulated, or pulsed. See columns 4 and 5. MacKichan also teaches that for effective OTDR measurements, the pump light must be propagating in the opposite direction as the signal light. See the first full paragraph of column 5. See also the discussion of claim 1 regarding the teachings of MacKichan when taken in view of the prior art of Grubb.

Regarding claim 18, see the discussion of claims 1 and 13.

Regarding claim 19, MacKichan teaches that the pump and the monitor are used to locate fiber cuts in the span. Line 37 of column 2.

Regarding claim 23, MacKichan teaches that the control unit is configured to provide information on the corresponding backscattered pump light to a network management system (at the terminal). See generally, column 6, where the distress transmitter transmits information on the location of the fiber brake to a network management system.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacKichan in view of Grubb as applied to claim 1 above, and further in view of Emori et al. (Elect. Lett. 34:22) (hereafter "Emori").

Regarding claim 2, MacKichan does not teach the use of a Raman pump that comprises a plurality of laser diodes operating at different pump wavelengths. Such is well known in the art for use with Raman amplifiers. As the use of Raman amplification rather than active-ion amplification is well-known in the art, which is discussed with respect to claim 1, it would have been obvious to implement a well-known Raman pump source to pump the Raman amplifier. Emori and Grubb teach that the use of multi-wavelength pumps is advantageous in increasing the amplification bandwidth in a Raman amplifier. However, only Emori teaches the use of a plurality of laser diodes to perform that pumping. See specifically, Fig. 1. It would have been obvious to further modify the prior art of MacKichan when taken in view of Grubb to include multiple laser

diodes as pump sources because such a configuration is a well-known Raman pumping scheme.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacKichan in view of Grubb as applied to claim 1 above, and further in view of Lees et al. (Elect. Lett. 33:12) (hereafter "Lees").

Regarding claim 3, MacKichan teaches that the control unit is configured to modulate the pump light to produce a series of pulses having pulse widths. See specifically, column 4, last paragraph. MacKichan does not teach that these pulses have widths in the range of 1-200 ns. Such a range of pulse widths in the use of OTDR with Raman pumps is well known in the art. Lees teaches modulating a Raman pump source so that the pulse width is 28 ns. See Lees pg. 1082. It would have been obvious to further modify MacKichan to utilize the claimed pulse widths because such pulse widths are commonly employed for Raman pumps in OTDR systems.

Claims 5 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacKichan in view of Grubb as applied to claim 1 above, and further in view of Mahgerefteh et al. ('323) (hereafter "Mahgerefteh").

Regarding claim 5, MacKichan does not teach that the control unit is configured to use the Raman pump and optical monitor to gather information of the Raman gain coefficient of the transmission fiber. Mahgerefteh teaches the use of a pulsed light source (similar to that used in the MacKichan OTDR) and a controller that is configured

to use the pulsed pump light source to determine the Raman gain coefficient of the optical fiber. See generally, columns 3-5. It would have been obvious to modify the prior art OTDR of MacKichan to utilize the controller and the pump source to perform Raman gain coefficient measurements because the use of a pulsed pump source and a controller is commonly employed to determine the Raman gain coefficient of a Raman amplifier fiber.

Regarding claim 21, see the discussion of claim 5.

Claims 8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacKichan in view of Grubb as applied to claim 1 above, and further in view of Kinoshita ('965) (hereafter "Kinoshita").

Regarding claim 8, MacKichan teaches a wavelength selective splitter, which is a type of WDM coupler. See the discussion of claim 7. MacKichan does not teach that the WDM coupler is the same coupler for both the pumping light and the monitor. Such an arrangement for monitoring backscattered (or back reflected, or residual) pumping light is known in the art. Kinoshita teaches a WDM coupler that is coupled to the span of transmission fiber and that separates the backscattered pump light from the optical data signals being amplified on the span and that directs the pump light into the span of transmission fiber. See generally, the discussion at columns 41 and 42. Also see Fig. 30, where WDM coupler, 34-1 performs the claimed function.

Regarding claim 10, MacKichan teaches a WDM coupler that is coupled to the transmission fiber and that separates the backscattered pump light from the optical data

signals being amplified on the span. MacKichan does not teach a circulator that directs the Raman pump light into the WDM coupler, which in turn directs the pump light into the transmission fiber, and that directs the backscattered light towards the optical monitor. Such a configuration is known in the art. Kinoshita (Fig. 30) teaches a monitoring and pumping scheme wherein a circulator, 33, directs pump light into an optical amplifier, 31, through WDM coupler 34-1. Kinoshita also shows that back-reflected pump light (reflected off of mirror 35) is sent through the circulator, 33, to a monitor 36. It would have been obvious to further modify the monitoring configuration of MacKichan to include the circulator and the claimed arrangement because such an arrangement is well known in the art and implementing such a scheme would produce no unexpected results.

Claims 14 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacKichan in view of Grubb or alternatively, MacKichan in view of Grubb as applied to claim 13 above, and further in view of Hoshida et al. (OFC March 2001) (hereafter "Hoshida").

Regarding claim 14, MacKichan teaches that the control circuit is configured to modulate the pump light during a setup procedure in which the span of transmission fiber is being characterized. This is inherent in the teachings of MacKichan as his apparatus will perform OTDR (which requires that the pump light be modulated) when the control signal is not received. Therefore, the MacKichan amplifier and controller will

perform OTDR when the fiber is undergoing a setup procedure and characterize the continuity of the transmission fiber.

Alternatively, MacKichan does not teach that the control circuit is configured to modulate the pump light during a setup procedure in which the span is being characterized. Such is taught in the Hoshida. Hoshida teaches characterizing a DRA (distributed Raman amplifier) using OTDR (which inherently includes modulation). Furthermore, such a characterization is performed for predictive purposes, meaning that the signals are not present in the fiber, as it is merely being characterized to determine its operation parameters. It would have been obvious to further modify MacKichan to utilize the modulation of the pump light during a setup procedure when the span of transmission fiber is being characterized.

Regarding claim 20, MacKichan does not teach that the control unit is configured to determine which types of fiber are located in the span of transmission fiber. Hoshida teaches that OTDR can be used in a characterization of the transmission path, and determine the variations in the loss distribution profiles in Raman fiber amplifiers, this is due to the different types of fiber used in the transmission system. It would have been obvious to further modify MacKichen to use the OTDR (the pump and the controller and monitor) to determine what types of fiber are in the transmission system because such is an well known use of OTDR.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacKichan in view of Grubb as applied to claim 13 above, and further in view of Large et al. ("621) (hereafter "Large").

Regarding claim 22, MacKichan does not teach that the control unit is configured to use the pump and optical monitor to determine when the reduce the power of the Raman pump to an eye safe level. As is known in the art, Raman pumps are dangerous to the eye, and when a fiber brake occurs, this danger is magnified. See Large at column 1. Large explicitly teaches a method of determining when an optical fiber is broken and then shutting off a pump (or at the very least reducing it to a safe level). See generally, columns 1-3. It would have been obvious to further modify MacKichan to reduce the level of the pumping to an eye-safe level because such a modification would increase the safety of the system and has been a well-known method of increasing safety in Raman amplifiers.

Allowable Subject Matter

Claims 11, 12, and 15-17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Claims 11, 12, and 16-17: The prior art of MacKichan teaches an EDFA which is pumped at a single wavelength to perform both optical amplification and OTDR functions. Grubb et al. ('922) teaches a Raman amplifier thaat is pumped at a plurality of wavelengths. The references in combination, or when taken alone do not teach or suggest that there should be two optical monitors for monitoring the backscattered pumping light.

Claim 15: The prior art of MacKichan does not teach that the OTDR and the pumping source can be used when the optical signals are present in the link, but rather teaches that the pump modulation must be used when in an alternate operational mode, therefore teaching away from the claimed invention. No other prior art reference teaches that the signals can be present in the system while performing OTDR using the pump light.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Jander ('206), Fatehi et al. ('255), Nishi et al. ('126), Stallard et al. ('149), Spirit et al. ('965), Horiuchi et al. ('375), Hamada ('658), Kada et al. ('912), Marcerou ('695), and Naganuma ('025) all teach OTDR or surveillance of optical amplifiers and transmission systems. Horisuchi et al. (PTL 4:1), Isumita et al. (OFC 1997), Sato et al. (Instrumentation and Measurement Technology Confernece, 1994),

Spirit et al. (Elect. Lett. 25:25), Sato et al. (PTL 00:0) all teach Raman assisted OTDR. Okuno 2001/0040719 teaches a control and monitoring system for a Raman amplfieir.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew R Sommer whose telephone number is (703) 605-4274. The examiner can normally be reached on M - F 7:00 - 3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas H. Tarcza can be reached on (703) 306-4171. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9326 for regular communications and (703) 872-9327 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1113.

ars
May 24, 2002

Thomas H Tarcza

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